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Editor's note: Phillip A. Gribble, PhD, ATC, is an associate professor in the Department of Kinesiology, director of the Athletic Training Research Laboratory, and director of the Graduate Athletic Training Program at the University of Toledo and a member of the JAT *Editorial Board.*

I thank the editors of the *Journal of Athletic Training* for the opportunity to comment on the importance of defining experimental groups in studies that examine persistent ankle instability. Additionally, I would like to thank Drs Brown, Padua, Marshall, and Guskiewicz for allowing additional commentary on their article "Hip Kinematics During a Stop-Jump Task in Patients With Chronic Ankle Instability." They have presented an interesting, well-written study that contributes to the understanding of ankle instability and its consequences and should help to shape future clinical and research practice in the management of this condition.

Hertel[1] was the first to identify and recommend a delineation of mechanical and functional factors that in combination create chronic ankle instability (CAI). An important tenet from that article is that clinicians and researchers should not focus solely on mechanical ankle instability (MAI) or functional ankle instability (FAI) to categorize patients or research participants; rather, we should strive to understand how combinations of FAI and MAI propagate persistent problems at the ankle, or CAI. Before Hertel's definitions, overwhelming heterogeneity was common in defining participants with ankle injuries for research studies, with a wide range of inclusion criteria for those with postacute ankle instability. Over the last decade, the depth and breadth of research devoted to understanding CAI have grown exponentially. A large contribution to this improved knowledge base comes from researchers who have become mindful of the need to use clearer definitions and inclusion criteria for the injured participants in their studies.

In the current study, Brown et al have followed this accepted trend in research. They, like others, have delineated those with a history of ankle sprain into the classification of MAI, FAI, or coper. Although *CAI* has become an acceptable blanket term for a history of ankle instability, the criteria for this condition have not received consensus. Therefore, the authors should be commended, especially for including the coper group. Coper groups have been studied extensively in the anterior cruciate ligament injury literature over the past 2 decades to define people with the condition who do not demonstrate specified deficits (eg, giving way, loss of neuromuscular control, reduction in self-reported function) in the affected knee. This approach has led to new avenues of research and improved knowledge regarding anterior cruciate ligament injuries.

Clinicians have observed for years that some athletes and patients recover from an acute ankle sprain with no residual symptoms or episodes of reinjury, whereas others are plagued by multiple episodes of giving way, loss of neuromuscular control, feelings of instability, and subsequent reinjury to the ankle. Therefore, including a coper group in ankle research is becoming a more common component of well-designed studies and is critical to the understanding of CAI.[2]

Brown et al included a coper group in their study to determine how they may differ in selected outcome measures from other participants identified as having only MAI or FAI. In theory, this was an excellent design and could be a very useful model for future investigators to follow. The purpose of the study was to determine whether those with MAI or FAI differ from a coper group in their control of hip kinematics and ground reaction forces during a jumping task. The goal was to help elucidate the influence of isolated mechanical or functional limitations stemming from previous ankle injury on a dynamic task used in athletic participation during which injury often occurs. Some interesting findings suggest that the participants categorized with MAI had more functional limitations measured in the selected variables; the FAI and coper groups did not differ.

However, the fact that the MAI group appeared to have greater functional limitations than the FAI group indicates that the inclusion criteria might not have been selected or applied appropriately. To define *mechanical laxity*, the authors used a physical examination of ankle laxity with a validated rating scale; the MAI group had more laxity than the FAI and coper groups. Therefore, it does appear that the MAI group had more mechanical ankle laxity than the other groups. Unexpectedly, based on the selected criteria for functional limitations that were used to define the FAI group, the MAI group also seemed to have had at least the same level of or perhaps more functional instability than the FAI group.

The authors used 2 measures to define functional limitations: the number of self-reported episodes of the ankle giving way and a score on the Foot and Ankle Disability Index (FADI). Both measures are appropriate and have been used commonly in the recent ankle instability literature. Yet it is surprising that the FAI group did not necessarily present with more functional limitation than the MAI group. The authors indicated that the numbers of self-reported episodes did not differ between the MAI and FAI groups. In fact, the number was greater in the MAI group, and using the means and standard deviations provided, the effect size would be moderate (0.64),[3] suggesting that the MAI group had more functional limitations. Additionally, the number of episodes of giving way was not reported for the coper group. Without this information, we do not know whether the FAI and MAI groups differed from the coper group in this measure of functional limitation. Because the FAI group had fewer episodes of giving way than the MAI group, if they were not different from the coper group in this respect, the participants in the FAI group might not have had functional limitations from their ankle injuries.

The second criterion measure used to define FAI group inclusion was the FADI score. The FADI and similar measures of self-reported functional limitations have been used extensively

in the literature in recent years to increase homogeneity in identifying patients with ankle injuries, and I commend the authors for their use of this instrument. However, the FAI group in this study had better self-reported function on the FADI than did the MAI group and was not different from the coper group. This suggests that the MAI group and not the FAI group possessed a functional limitation.

Therefore, these 2 measures of participant identification indicate that the MAI group had more functional limitation than the FAI group and the coper group, and the FAI group might not have had functional limitation compared with the coper group. From the results of the identified measures of interest in the study, hip kinematics and ground reaction forces, the MAI group had a diminished level of functional performance, whereas the FAI group did not differ from the coper group. This finding further supports the possibility that functional limitation might have been present in the MAI group and not in the FAI group.

The authors did well to include a novel design that attempted to separate the MAI, FAI, and coper groups rather than only comparing those with CAI and healthy control participants, as is seen in the majority of this literature. Unfortunately, these authors may have misinterpreted or incorrectly applied the inclusion criteria they were attempting to use. Nonetheless, the finding that a group of patients with a history of ankle injury who self-reported functional limitations and presented with greater ankle laxity (MAI group) displayed differences in hip kinematics and ground reaction force compared with a group of copers is quite novel and has interesting implications for clinicians and researchers. In some ways, the MAI group may embody what the CAI definition is designed to exemplify: a condition that includes both mechanical and functional limitations. Future researchers should build on this study to address these limitations and what they mean for clinical management and improvement of chronic ankle injuries. This information should lead to improved interpretation of the criteria being applied, allowing development of the most appropriate set of criteria to shape consistency in the literature.

REFERENCES

1. Hertel J. Functional anatomy, pathomechanics, and pathophysiology of lateral ankle instability. *J Athl Train*. 2002;37(4):364–375.
2. Hertel J. The complex etiology of lateral ankle instability. *J Orthop Sports Phys Ther.* 2005;35(5):A9–A10.
3. Cohen J. *Statistical Power Analysis for Behavioral Sciences*. 2nd ed. Hillsdale, NJ: Lawrence Erlbaum Associates; 1988.

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Authors' Reply

We thank Dr Gribble for offering commentary on our article and the editors of the *Journal of Athletic Training* for the opportunity to respond. The reviewer has provided interesting and valuable insight into the difficulties of classifying and rating clinical conditions in ankle instability.

We fully agree with the reviewer that Hertel[1] suggested that chronic ankle instability (CAI) "may be caused by mechanical instability, functional instability, or a combination of these entities." Hertel[1] also stated, "While the dichotomy of functional and mechanical instability helps explain 2 common potential causes of CAI, it does not adequately reflect the complete spectrum of pathologic conditions to CAI," and "Specific insufficiencies interact to create either mechanical instability or functional instability." We support Gribble's and Hertel's statements that functional ankle instability (FAI) and mechanical ankle instability (MAI) probably combine to create the condition of persistent rolling, spraining, and giving way at the ankle. We have attempted not to focus solely on one construct or the other. Rather, we selected a group that displayed symptoms of CAI, some of whom also displayed obvious mechanical laxity, and compared them with people with CAI and less obvious mechanical laxity (FAI group). We took this approach as a first step toward Hertel's[1] recommendation to further elucidate the interactions among mechanical and functional insufficiency and the relationships between specific insufficiencies. As a point of clarification, we did not state that the MAI group had no evidence of FAI; indeed, they met the same inclusion criteria as the FAI group for entry into the study with regard to minimum injury history and self-reported episodes of giving way. However, they exhibited the additional component of mechanical laxity and, therefore, may be considered further along the continuum or spectrum of instability and thus more symptomatic than the FAI group, as Gribble argues.

A recent review by Delahunt et al[2] illustrated the difficulty researchers have in categorizing and classifying people with CAI, as evidenced by the great variety of inclusion and exclusion criteria. We think that our common inclusion criteria for the MAI and FAI groups match the same basic criteria as did the groups studied by the majority of the investigations outlined in the publication. We simply added an additional criterion of clinically obvious physiologic laxity to one subgroup.

Gribble highlights our use of the coper group, as suggested by Hertel and Kaminski.[3] We agree that this is a more relevant clinical comparison group, given the same injury exposure. Because it is a recent recommendation, few other authors have included this group, and the inclusion and exclusion criteria are not clearly defined for the research community. It is likely that the coper group fell along the continuum of instability, with fewer deficits than the MAI and FAI groups, but some overlap in their distributions was indeed possible.

We used self-reported episodes of giving way and scores on the Foot and Ankle Disability Index (FADI) and FADI-Sport subscale to describe functional limitations in our participants, not to define group inclusion and exclusion criteria. Gribble is correct in stating that the MAI group self-reported more episodes of giving way and lower FADI and FADI-Sport subscale scores, which indicated greater functional deficits. No cutoff scores were used for group inclusion criteria on the FADI or FADI-S because evidence for such scores is limited, and only recommendations exist.[4] Gribble is also correct that we did